

7000 Bus Converter

User Manual

For 7520, 7520R, 7520A, 7510A, ISA-7520

7000 New Features

- 1. Self Tuner Inside**
- 2. Multiple Baud Rate**
- 3. Multiple Data Format**
- 4. Dual WatchDog Inside**
- 5. True Distributed Control**
- 6. High Speed&High Density I/O**

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Patent pending

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1. Introduction

The 7000 are a family of remote controllable data acquisition modules. They provide A/D, D/A, DI/O, Timer/Counter, MMI and other functions. These modules can be remote controlled by a set of commands.

1.1 7000 Overview

7000 can be divided into several groups based on their function as following:

group 1 : bus converter modules, support bus converter & repeater

7520/7520R/ISA-7520R : RS-232 to RS-485 converter,
3000V isolation

7510 : RS-485 to RS-485 repeater, 3000V isolation

7520A : RS-232 to RS485&RS-422 converter, 3000V
isolation

7510A : RS-485 and RS-422 repeater, 3000V isolation

group 2 : DIO modules, support TTL, isolated DIO, relay & O. C.
output

7050 : TTL IO, 7*In, 8*Out

7052 : isolated DI, 8*In

7053 : Non-isolated DI, 16*In

7060 : isolated DI & relay output, 4*In+4*Relay

7041 : isolated DI, 14*In

7042 : isolated O. C. DO, 13*Out

7044 : high driver O.C. output I + isolated DI, 4*In+8*Out

7067 : relay output, 7*Relay

group 3 : DA module, support voltage/current output : 7021

group 4 : AD modules, support voltage/current/thermocouple/RTD
measurement

7011/7011D : single-channel thermocouple measurement

7012/7012D : single-channel large signal measurement

7013/7013D : RTD measurement

7014D : general analog signal measurement with LEDs display

7017 : multi-channel 7012

7018 : multi-channel 7011

group 5 : Timer/Counter modules : 7080, 7080D
group 6 : Man Machine Interface : MMICON=240*64 LCD+4*4
KBDs+8*function_key
group 7 : Power relay Modules :
RM104/108/116 : 4/8/16 channels of form-C, SPST, 400V AC, 16A
RM204/208/216 : 4/8/16 channels of form-C, SPDT, 400V AC, 5A
group 8 : Embedded Processor module
7188=188+Ram+Flash-Rom+more features
group 9 : wireless modem module : SST-288
group 10 : Power supply module
ACE-540A : 24V/2A power supply
DIN-540A : ACE-540A with DIN-RAIL mount
PWR-24/220V : 220V AC input, 24V/0.1A output power adapter
PWR-24/110V : 110V AC input, 24V/0.1A output power adapter

Over 10 modules are under development
ODM modules call for details.

1.2 7000 Related Documentation

- NAP7000S User Manual : for software NAP7000S, utility program source
- NAP7000P User Manual : for software NAP7000P, DLL driver for 7000
- NAP7000D User Manual : for software NAP7000D, DDE driver for 7000
- NAP7000L User Manual : for software NAP7000O, OLE driver for 7000
- 7000 Bus Converter User Manual : for
7510/7520/7520R/7520A/7510A
- 7000 DIO User Manual : for 7050/7052/7053/7060/7041/7042/7044/7067
- 7000 A/D Group1 User Manual : for 7017/7018/7013/7013D
- 7000 A/D Group2 User Manual : for 7011/7011D/7012/7012D/7014D
- 7000 D/A User Manual : for 7021
- 7000 Timer/Counter User Manual : for 7080D
- 7000 Embedded Controller User Manual : for 7188
- MMICON Hardware Manual : for MMICON
- MMIDOS User Manual : for MMICON software
- Application Note : EM001 → for MMICON evaluation

1.3 7000 Common Features

Isolation voltage : 3000 Vdc

Communication :

- Asynchronous half-duplex 2-wire RS-485 network
- Max. distance without repeater=4000 feet (1.2Km)
- **Speed=1200,2400,4800,9600,19200,38400,57600,115200**
- **Connecting 256 modules in one RS-485 bus without repeater**
- Multiple baud rate and multiple data format can share the same RS-485 bus(7520/7510)
- Different baud rate and the same module address can share the same RS-485 bus
- **Connecting 256*8=2048 modules max. in one RS-485 bus with repeater.**
- 7000 series data format=1 start + 8 data + 1 stop + no parity = 10-bit
- Two extra checksum bytes can be enable/disable
- Built-in transient voltage suppresser and PTC protector
- **Sharing the same RS-485 bus with the RS-485 or RS-232 device which communicates in multiple data format(not 10-bit) and multiple baud rate. (Use 7520 to convert RS-232 to RS-485)**

Power :

- +10V ~ +30V DC
- Power reverse protection, Over-voltage brown-out protection

System :

- Dual watchdog inside, power-on start value and safe value for host failure
- Operating temperature : -10 to 70°C (14 to 185°F)
- Storage temperature : -25 to 80°C (-13 to 185°F)
- Humidity : 5 to 95%, non-condensing

1.4 7000 System Network Configuration

- Multiple Baud Rate
- Multiple Data Format

PATENT PENDING

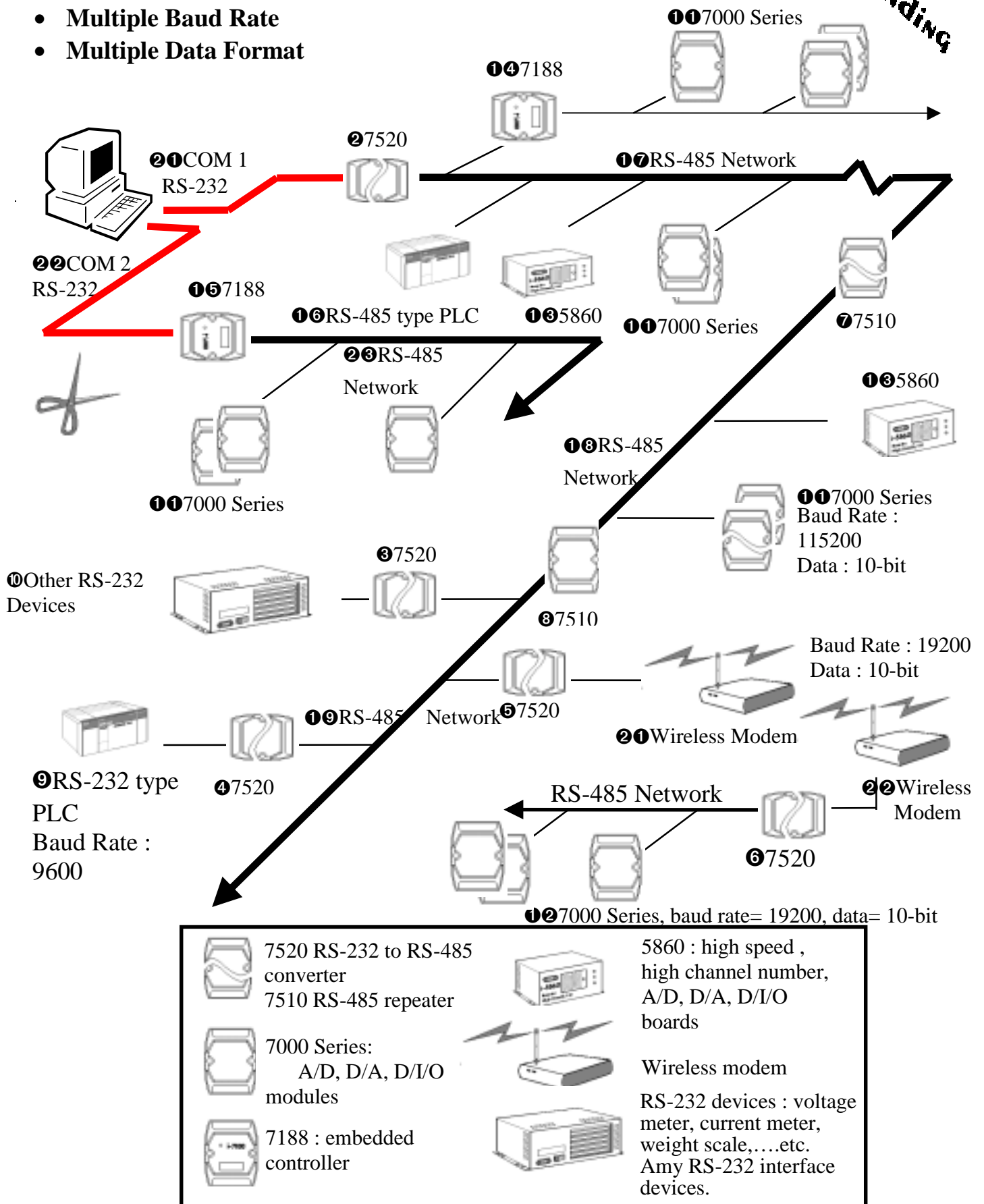


Fig 1

Conventional Two-Wire RS-485 Network: The conventional two-wire RS-485 network use a DIP SWITCH selectable converter to convert host RS-232 signal to two-wire RS-485 signal. The baud rate and data format must be setted in fixed value in whole network. For example the user can choose baud rate=9600 and data format=10 bit per character. This limitation is inconvenient in some real world application. The 7000 series, Adam 4000 series, Nudam 6000 series and DATAFORTH 9B series all use 10-bit format. Some conventional PLC use 11-bit data format and some weight scale equipment use 12-bit. If the host-PC has to send command to remote module, PLC and weight scale equipment, one possibility is to use three independent two-wire RS-485 network. That may increase the system cost and reduced the system reliability.

The user may use many modules in the same two-wire RS-485 network in real world applications. All these modules must communicate in the same baud rate in the conventional system. Some of those modules may be very close to host-PC and can communicate with high baud rate. Some modules may be far away from the host-PC and communicate with low baud rate. Because only one speed is validate in the RS-485 network, the high speed modules should be forced to communicate in low speed baud rate. The performance of the whole system should be decreased.

7000 RS-485 Network: The 7000 RS-485 network is the most powerful and flexible two-wire RS-485 network in the world. It is a multiple baud rate and multiple data format network system. That is to say, all these remote modules, PLCs, weight scale equipment mentioned above can share the same RS-485 network. The 7520, RS-232 to RS-485 converter, equips a " **Self Tuner**" inside, therefore it can detect the baud rate and data format automatically and control the direction of RS-485 network precisely. So the user can connect all these equipment to the same RS-485 network. This will reduce system cost and increase reliability very much.

Operation Principle (Refer to Fig 1):

- (1) The ❶Host PC send out command via the ❷❶COM1.
- (2) The ❷7520 convert this RS-232 signal into ❶❷RS-485 signal.
- (3) All modules connecting to ❶❷RS-485, ❶❸RS-485 and ❶❹RS-485 network will receive this command at the same time. Then all modules will start to extract the destination address field and compare to its local module address.
- (4) The module with match address will continue to execute this host command and the other modules will bypass this command.
- (5) After executing the host command, the destination module will send the result back into RS-485 network. The ❶Host PC will interpret this result and take action.

Isolated Repeater: The ❷7510 & ❸7510 are used to extend the ❶❷RS-485 to ❶❸RS-485 & ❶❹RS-485 for three conditions as following : (1) the RS-485 path over 1.2Km or 4000 ft (2) connecting over 256 modules in one RS-485 segment (3) break the long RS-485 path into several short & isolated RS-485 paths for safety consideration.

Multiple Baud Rate : The modules connecting in the 7000 two-wire RS-485 network can communicate to ❶Host PC with different baud rate. For example, the max. speed of ❷❶Wireless Modem & ❷❷Wireless Modem is 19200 BPS, but all 7000 series module can working under 115200 BPS. Some conventional PLC can only communicate at 9600 max. The 7520 can auto switch the baud rate from 300 BPS to 115200 BPS. Therefore the user can connect all these device into the same RS-485 network. The ❶Host PC will send out the different baud rate command and only the corresponding destination module will recognize this command and echo its result. All the other modules can recognize this command as a invalidate command and bypass it.

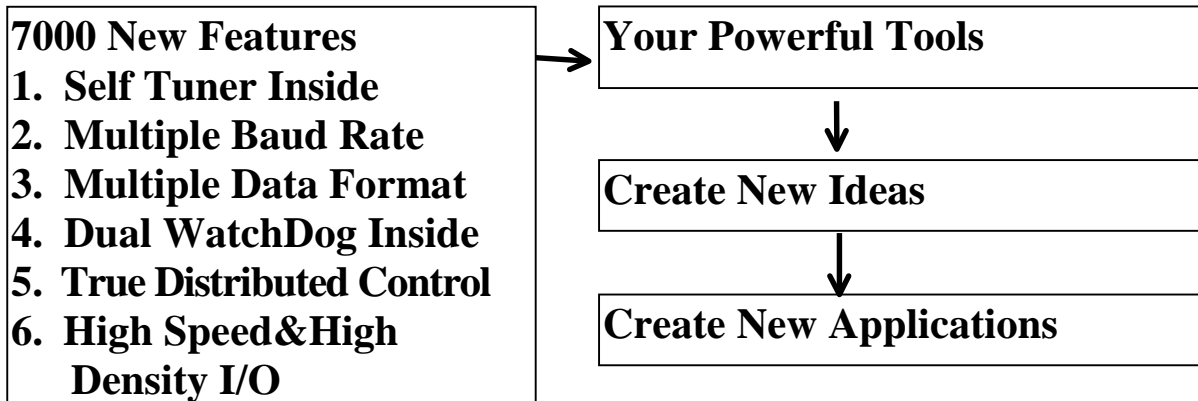
Multiple Data Format: The RS-232 is a serial signal and must be transmitted in START-bit+DATA-bit+PARITY-bit+STOP-bit. The format of ICP CON is " 1 START-bit+8 DATA-bit + no PARITY-bit + 1 STOP-bit" , totally 10 bits. But the conventional PLC use " 1 START+7 DATA+1 PARITY+2 STOP" , totally 11 bits. The ❶Host PC can send and receive any data format command. The devices connecting in the 7000 two-wire RS-485 network can communicate to ❶Host PC with different data format. This feature make the user can use one two-wire RS-485 network to connect remote modules, PLCs, RS-232 devices and instrument in the most reliable and low cost way.

Dual WatchDog Inside: All 7000 modules equip hardware module watchdog and software host watchdog. The 7000 series are designed for industry applications, therefore they can work in the harsh environment. There are many couple noise or energy transient in such environment. The modules may be down if these noise is really too large. The built-in hardware module watchdog can reset the module if it is down for too large signal. Sometimes even the host-PC may be down for hardware or software reasons. The software host watchdog can monitor the status of host-PC. If the host-PC is down, all the output of 7000 modules will go to their predefined safe states for safety protection.

If the RS-485 network is open, all the host command can not send to remote modules. This is very dangerous in real world application. The 7000 output module will force their output going to their predefined safe state for safety consideration if the host watchdog is enable. This dual watchdog feature will increase the system reliability very much.

True Distributed Control: The ❶❷ 7188 and ❶❸ 7188 are equipped with a 80188, ram, flash eeprom and can download the user program. Therefore they can handle the control details without ❶Host PC. This is a very important feature of 7000. All the 7000 modules work in " SLAVE" state. They are all waiting for commands and then take response. They can not take any action to ❶Host PC in any condition. Therefore the user can not handle the timing critical and emergency event by using 7000 modules. The 7188 is the best choice for this application. The ❶❸ 7188 can work in stand alone mode after the control program is down load.

High Speed & High Density I/O: The 135860 is a 586 PC based controller. It can plug-in isolated D/I, D/O, A/D, D/A cards as needed. The 135860 equips a RS-485 interface to connect to 7000 directly. The built-in electronic ram/rom disk make it very suitable for industry application. The full line of high density isolated cards make it very easy to handle high channel number applications. For example, The user can install 3 cards to get " 32 chnnel A/D + 16 Channel D/A + 32 channel D/I + 32 channel D/O" .



1.5 7000 Dimension

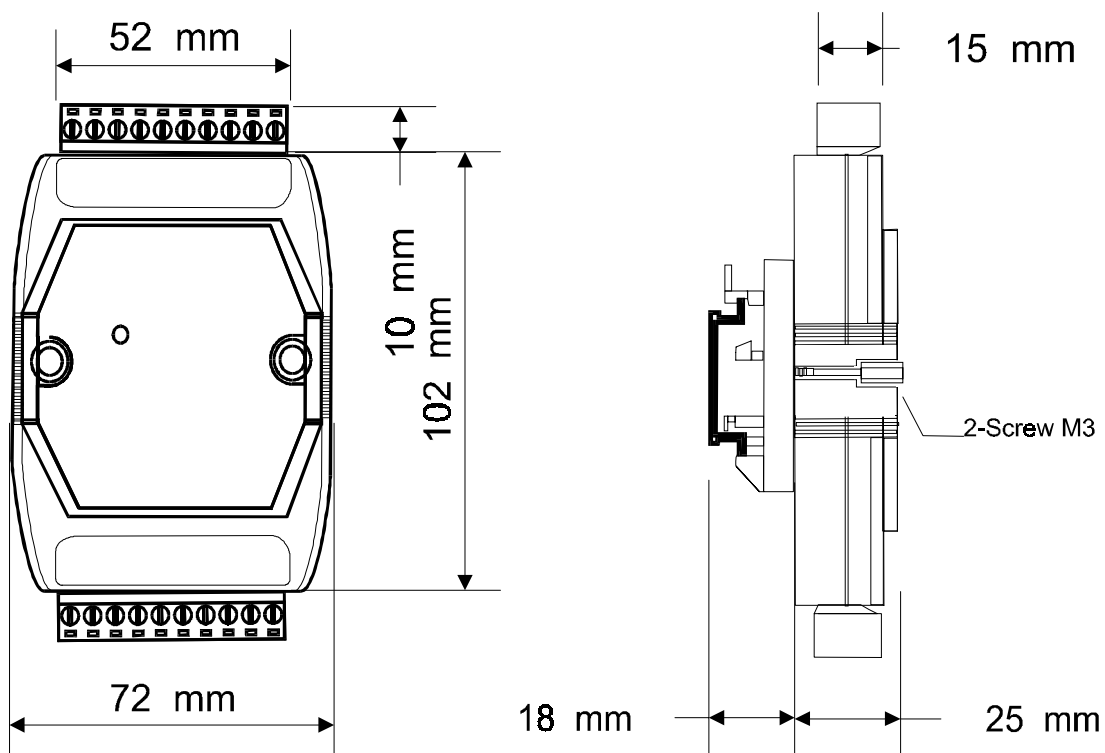
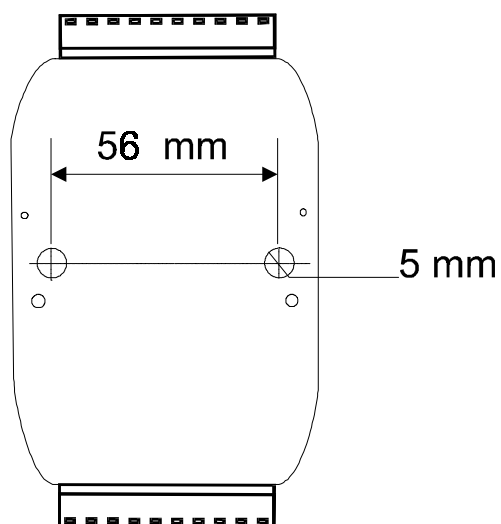


Fig 2

FRONT VIEW

SIDE VIEW



REAR VIEW

TOP VIEW

Fig 3

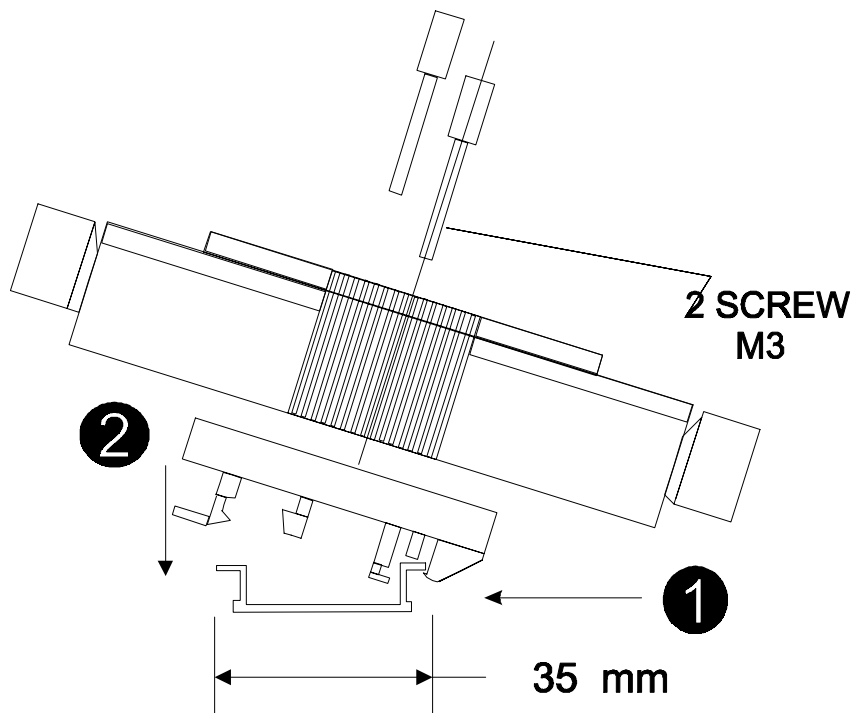


Fig 4

DIN-RAIL Mounting

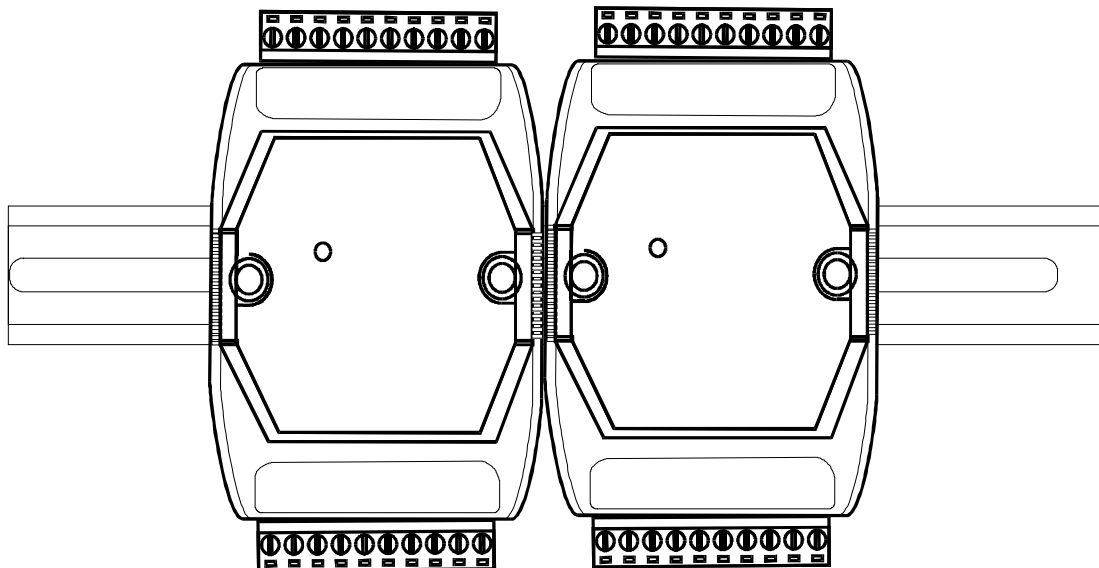


Fig 5

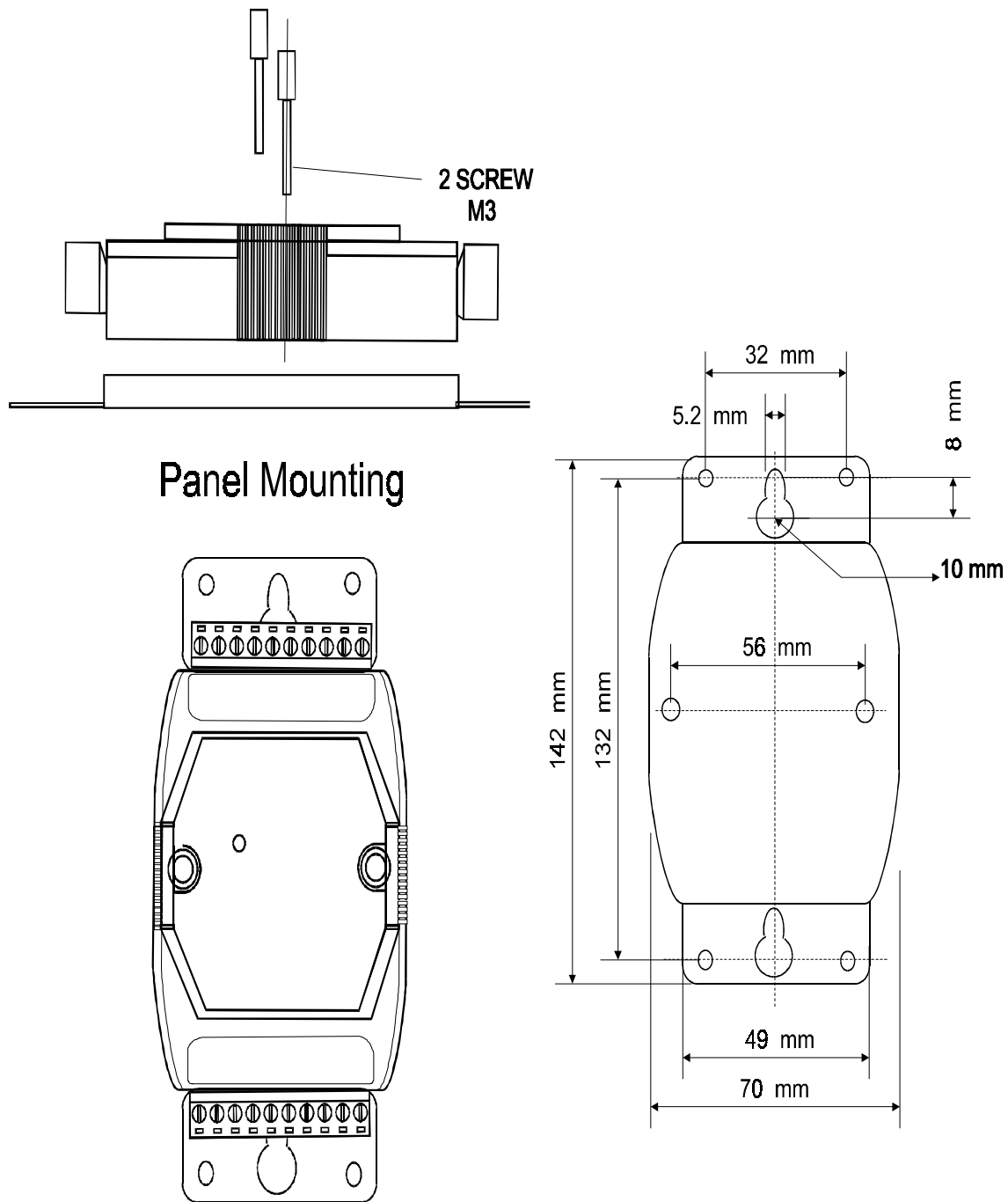


Fig 7

Plastic Part for Panel Mount

2. 7520 / 7520R/7520A/ISA-7520R

2.1 Pin Assignment

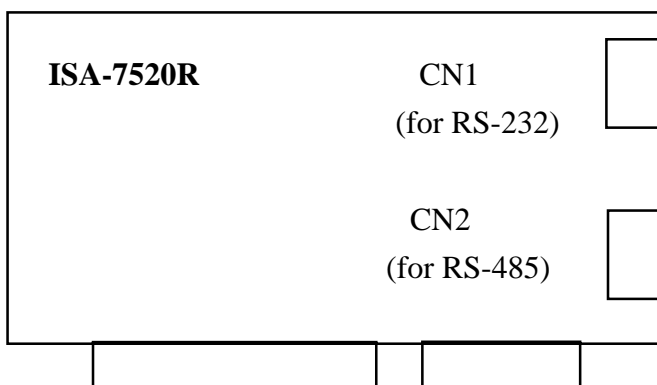
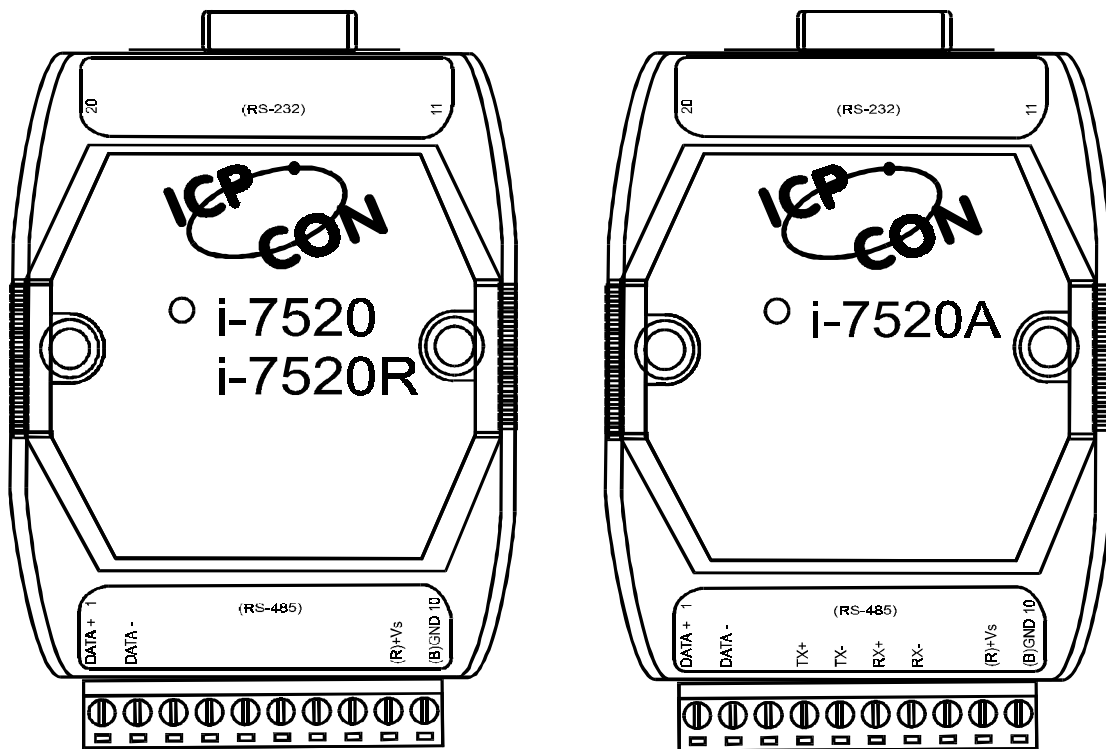


Fig 8

CN-1.2 connect to RS-232.2
CN-1.2 connect to RS-232.2
CN-1.2 connect to RS-232.2

CN2.1 = D+
CN2.2 = D+
CN2.6 = D-
CN2.7 = D-

The ISA-7520R is exactly the same as 7520R except the ISA interface. It is designed for easy installation.

2.2 Specifications

7520 : RS-232 to RS-485 Converter

- Protocol : two-wire RS-485, (D+,D-), protocol
 - Connector : plug-in screw terminal block
 - Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
 - 256 modules max in one RS-485 network without repeater
 - 2048 modules max in one RS-485 network with repeater
 - Isolation voltage : 3000V
 - Isolation site : RS-232
 - Repeater request : 4,000 feet or over 256 modules
 - Power requirements: +10V to +30VDC
- Power consumption : 2.2W(Max)

7520R : RS-232 to RS-485 Converter

- Protocol : two-wire RS-485, (D+,D-), protocol
 - Connector : plug-in screw terminal block
 - Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
 - 256 modules max in one RS-485 network without repeater
 - 2048 modules max in one RS-485 network with repeater
 - Isolation voltage : 3000V
 - Isolation site : RS-485
 - Repeater request : 4,000 feet or over 256 modules
 - Power requirements: +10V to +30VDC
- Power consumption : 2.2W(Max)

7520A : RS-232 to RS-485 or RS-422 Converter

- Protocol : RS-485 or RS-422
 - Connector : plug-in screw terminal block
 - Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
 - 256 modules max in one RS-485 network without repeater(for RS-485)
 - 2048 modules max in one RS-485 network with repeater(for RS-485)
 - Isolation voltage : 3000V
 - Isolation site : RS-232
 - Repeater request : 4,000 feet or over 256 modules
 - Power requirements: +10V to +30VDC
- Power consumption : 2.2W(Max)

ISA-7520R : PC-based RS-232 to RS-485 Converter

- ISA bus interface
- Protocol : two-wire RS-485, (D+,D-), protocol
- Connector : plug-in screw terminal block
- Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
- 256 modules max in one RS-485 network without repeater
- 2048 modules max in one RS-485 network with repeater
- Isolation voltage : 3000V
- Isolation site : RS-485
- Repeater request : 4,000 feet or over 256 modules

The ISA-7520R is exactly the same as 7520R except the ISA interface. It is designed for easy installation.

2.3 Block Diagram

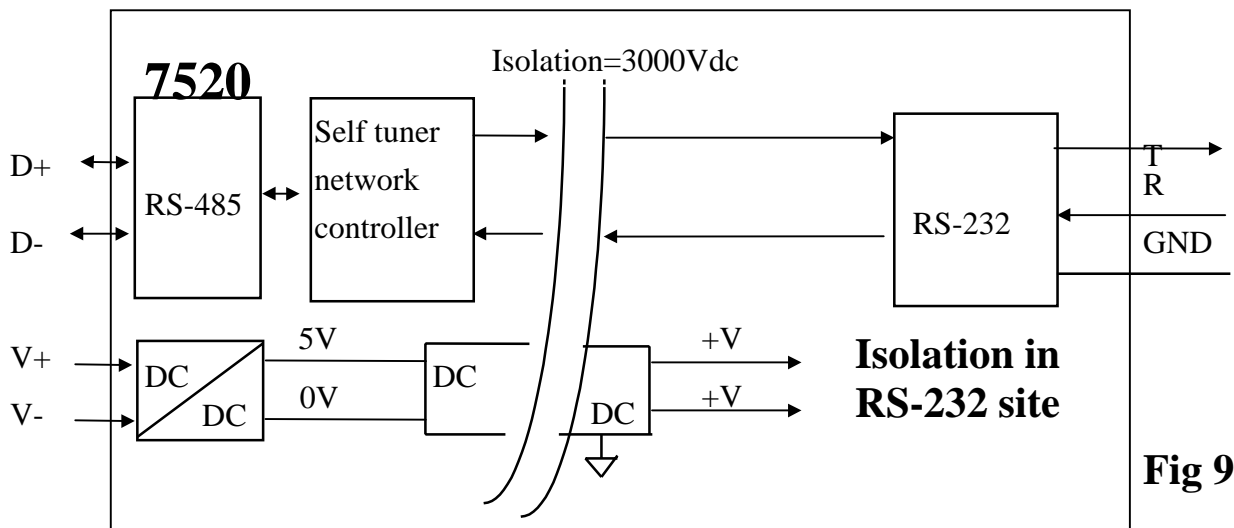


Fig 9

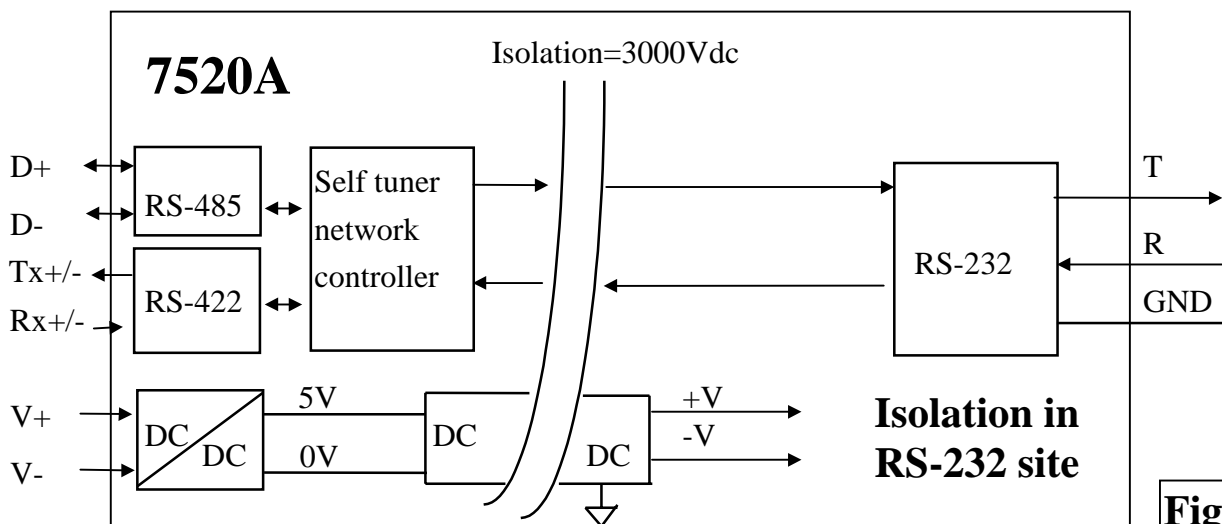
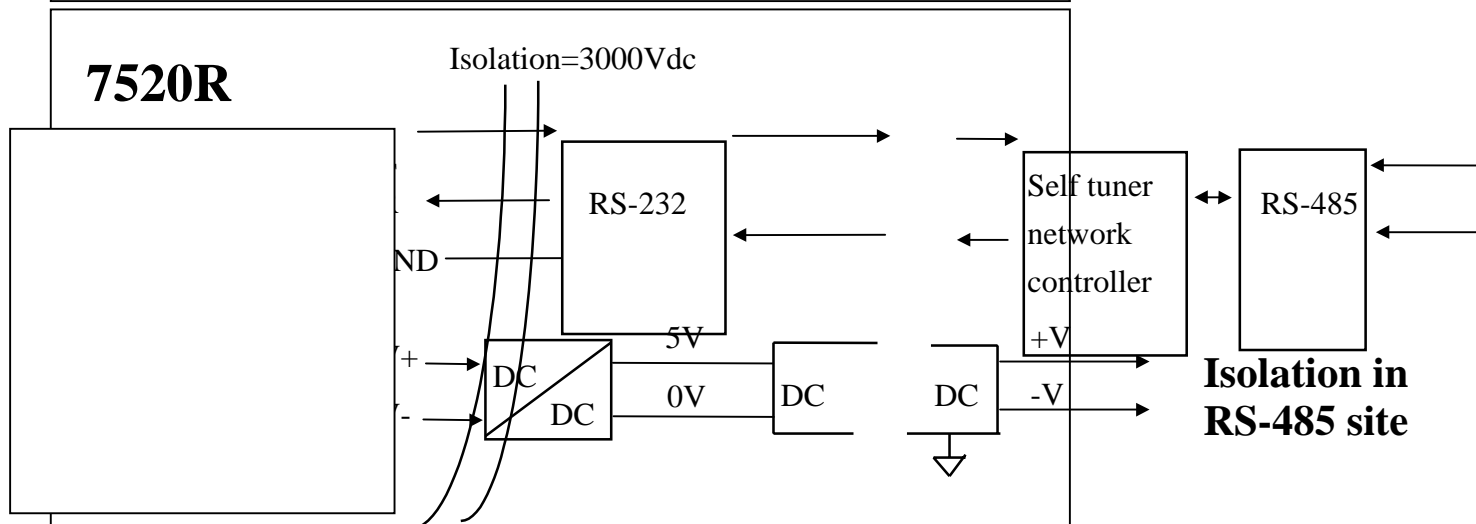


Fig 11

2.4 Basic Wire Connection

RS 485 wire connection.

GND \leftrightarrow Ext. Power GND

+VS \leftrightarrow Ext. Power 10V-30VData- \leftrightarrow Data-
$$\text{Data} + \leftarrow \rightarrow \text{Data} +$$

RS 232 wire connection

$$\text{host pin2(RXD)} \leftrightarrow 7520_pin2$$
$$\text{host pin3(TXD)} \leftrightarrow 7520_pin3$$

host pin5(GND) \leftrightarrow 7520_pin5

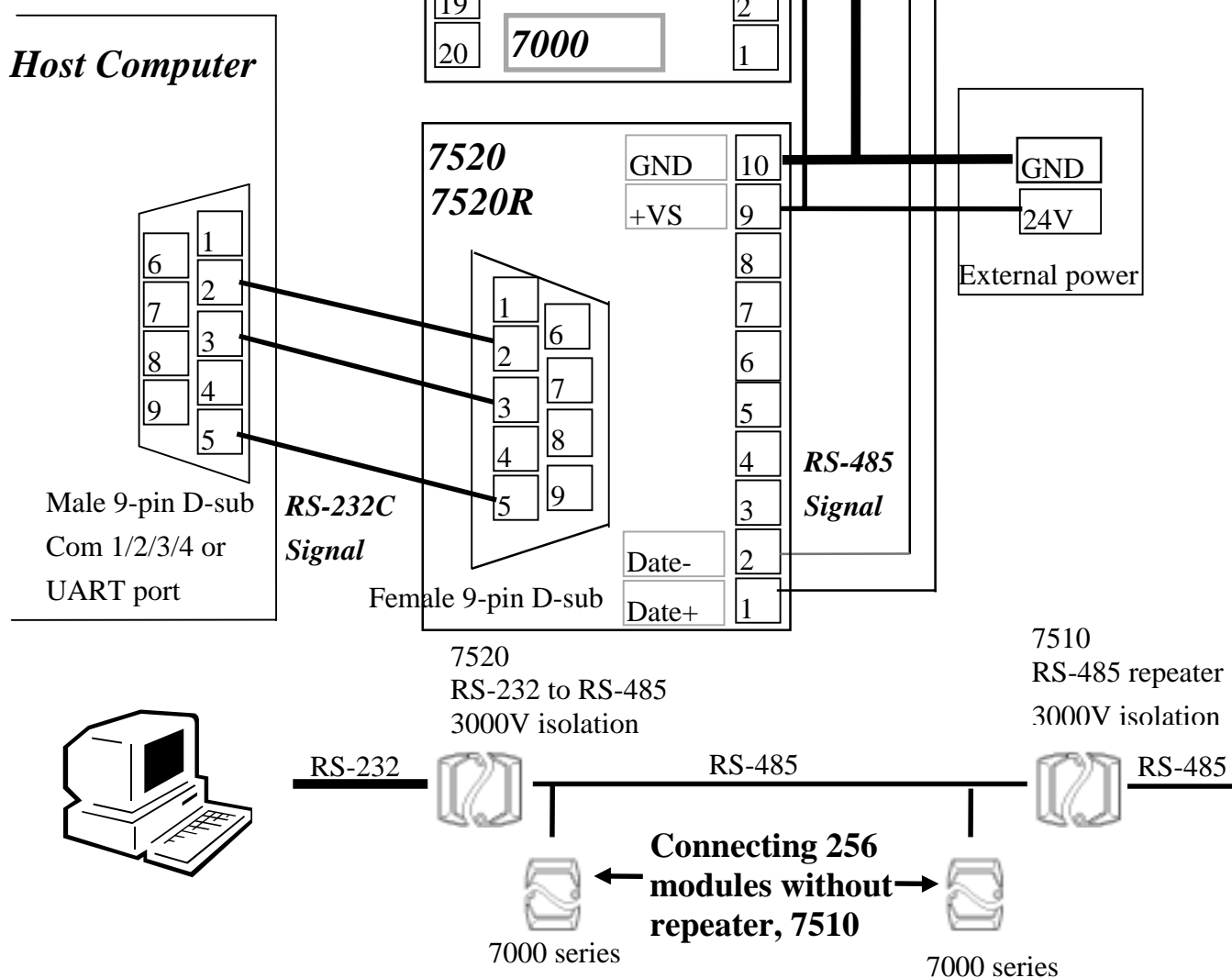


Fig 12

2.5 How to Select 7520/7520R

7520R is exactly the same as 7520 **except the isolation site**. The isolation site of **7520** is located in **RS-232 interface circuit**, but the isolation site of **7520R** is located in **RS-485 interface circuit**. That is to say, the power input and RS-485 interface is common ground for 7520 but the power input and RS-232 interface is common ground for 7520R as following:

	7520	7520R
RS-485 site	Common ground	Isolation site
Power ground		Common ground
RS-232 site	Isolation site	
Applications	Most applications.	
		For RS-232 type PLC networking

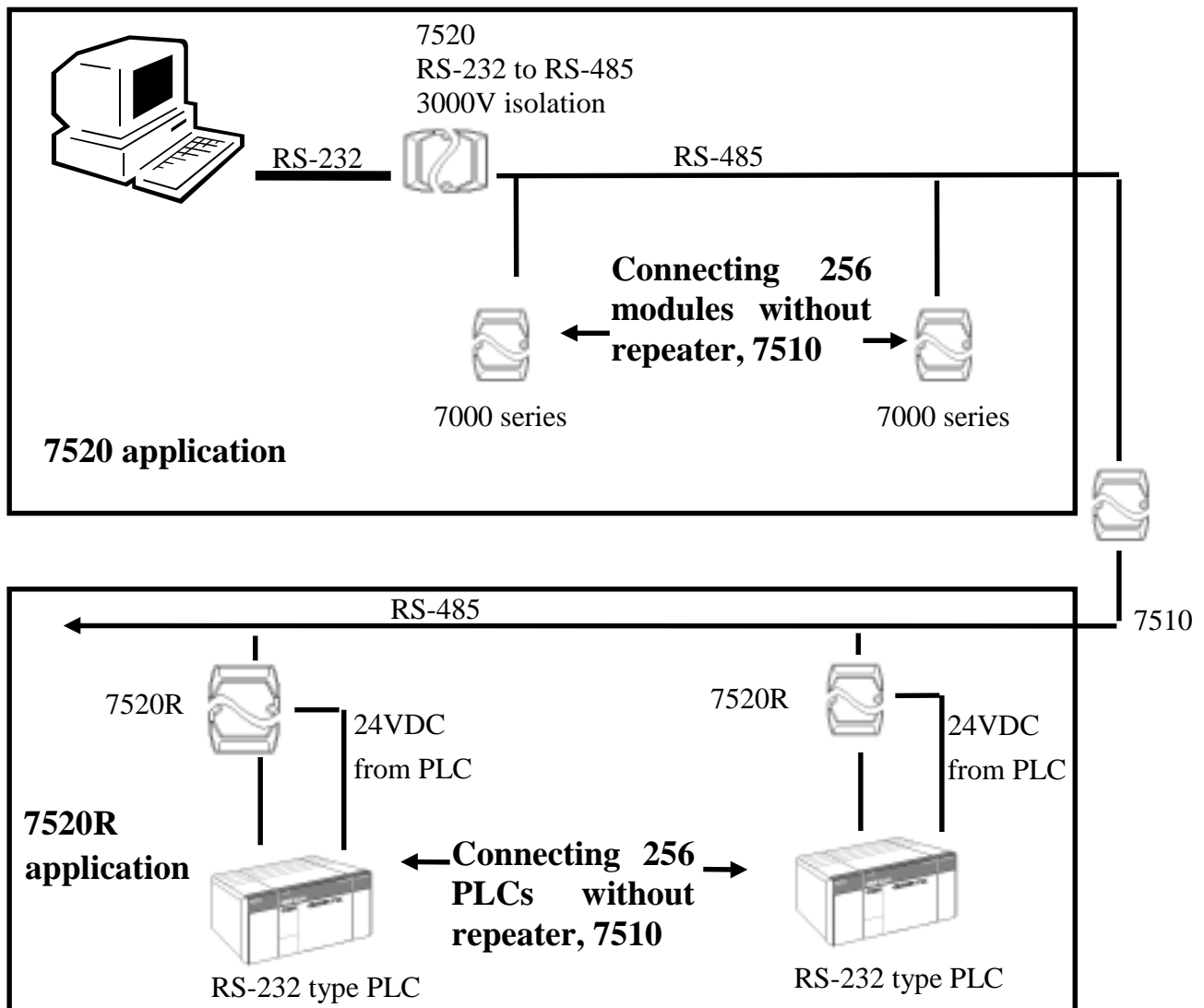


Fig 13

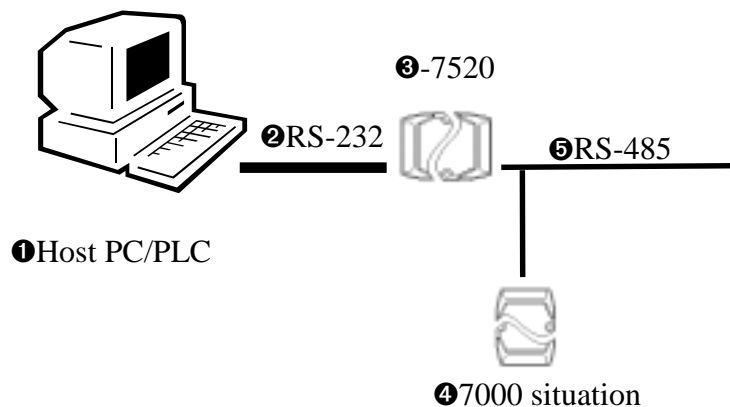


Fig 14

Note : the power ground of ④7000 and ⑤RS-485 is **common ground**. This is the same for Adam 4000, Nudam 6000 and DATAFORTH 9B series modules.

In most applications, the ③7520 is used to convert the ②RS-232 signal to ⑤RS-485 network. Normally the ③7520 does not use the same DC power ground as the ①Host PC/PLC, and the isolation site is in RS-232 part. Therefore the ①Host PC/PLC is isolated from ⑤RS-485 network. That is to say, if there are any high voltage transient on ⑤RS-485 network, the ①Host PC/PLC will be free from damaged.

WARNING!! ERROR CONDITION 1: if the ③7520 is replaced by ③7520R and the ③7520R use the same DC power ground with ④7000. In this situation,

- (1) The ①Host PC/PLC is common ground with ②RS-232
- (2) The ②RS-232 is common ground with power ground of ③7520R
- (3) The power ground of ③7520R is common ground with power ground of ④7000
- (4) The power ground of ④7000 is common ground with ⑤RS-485

Therefore the ①Host PC/PLC is common ground with ⑤RS-485 network. That is to say, there is no isolation between ①Host PC/PLC and ⑤RS-485 network. The ①Host PC/PLC may be damaged if there are high voltage transient on ⑤RS-485 network.

WARNING!! ERROR CONDITION 2: if the ③7520 is use the same DC power ground with ①Host PC/PLC (for example, ①Host PC/PLC provide non-isolated DC power source to ③7520). In this situation,

- (1) The ①Host PC/PLC is common ground with power ground of ③7520
- (2) The power ground of ③7520 is common ground with ⑤RS-485

Therefore the ①Host PC/PLC is common ground with ⑤RS-485 network. That is to say, there is no isolation between ①Host PC/PLC and ⑤RS-485 network. So the ①Host PC/PLC may be damaged if there are high voltage transient on ⑤RS-485 network.

OK CONDITION : If the DC power ground of ③7520 or ③7520R does not common to any module, the ①Host PC/PLC will be isolated from ⑤RS-485 network in any condition.

The power adapter PWR-24 is designed for single 7000 module only. The 24V DC output of PWR-24 is isolated from its AC input. If the ③7520 or ③7520R is connecting to PWR-24, this PWR-24 can not connect to the other module. Normally the ①Host PC/PLC use a switching power and the DC output of this power supply is also isolated from its AC input. Therefore the DC power ground of ③7520 or ③7520R is isolated from ①Host PC/PLC. So the ①Host PC/PLC is isolated from ⑤RS-485 network in any condition.

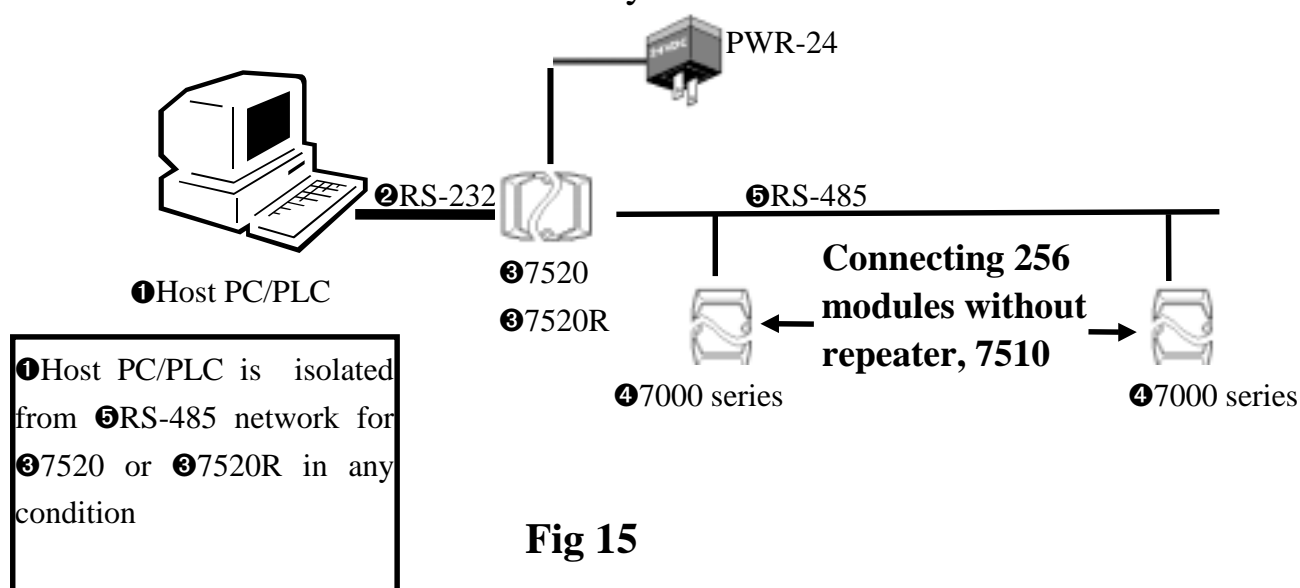


Fig 15

The 7520R is designed for PLC networking. In the normal condition, the PLC system will have a stable DC-24V power source. The user may use this power source to ⑥7520R(configuration_A). When using ⑦7520, the user must use another power source, ③PWR-24(configuration B).

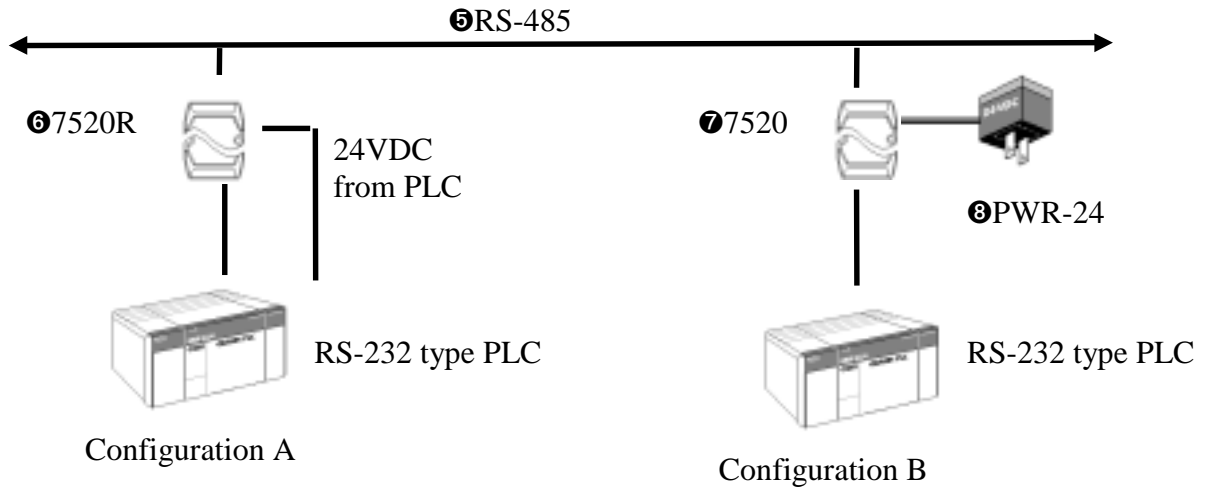


Fig 16

The isolation feature is very important in real world application, therefore the user should pay more attention to select correct module. If selecting wrong module, the isolation will be removed but the module will still function OK. This may cause unexpected damaged by high energy transients on RS-485 network.

3. 7510/7510A

3.1 Pin Assianment

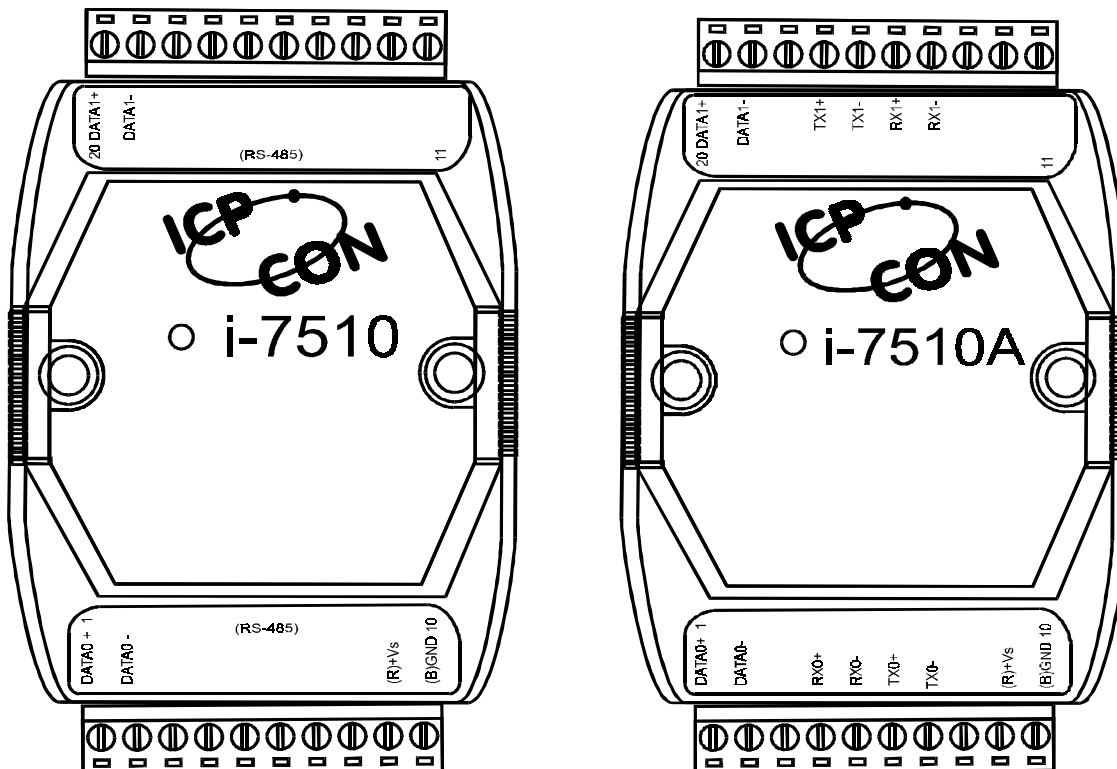


Fig 17

3.2 Specifications

7510 : RS-485 Repeater

- Input : two-wire RS-485, (D+,D-), protocol
- Output : two-wire RS-485, (D+,D-), protocol
- Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
- Isolation voltage : 3000V
- Connector : plug-in screw terminal block
- Power requirements : +10V to +30VDC
- Power consumption :

7510A : RS-485/RS-422 Repeater

- Input : RS-485/RS-422
- Output : RS-485/RS-422
- Speed : " Self Tuner" inside, auto switching baud rate, from 300 to 115200 BPS
- Isolation voltage : 3000V
- Connector : plug-in screw terminal block
- Power requirements : +10V to +30VDC
- Power consumption : 2.2W(Max)

3.3 Block Diagram

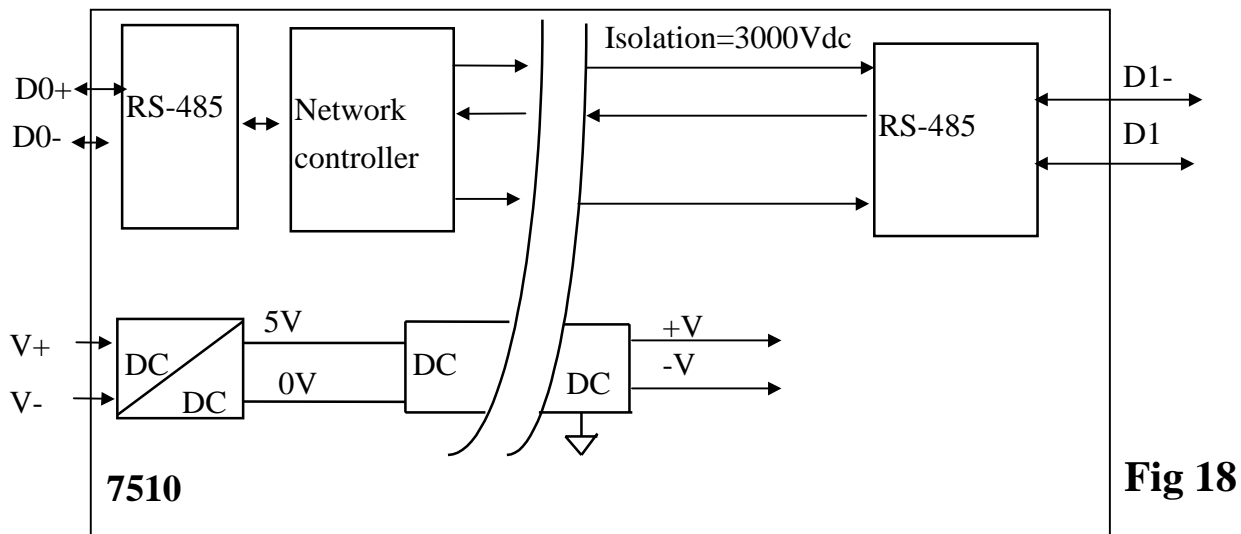


Fig 18

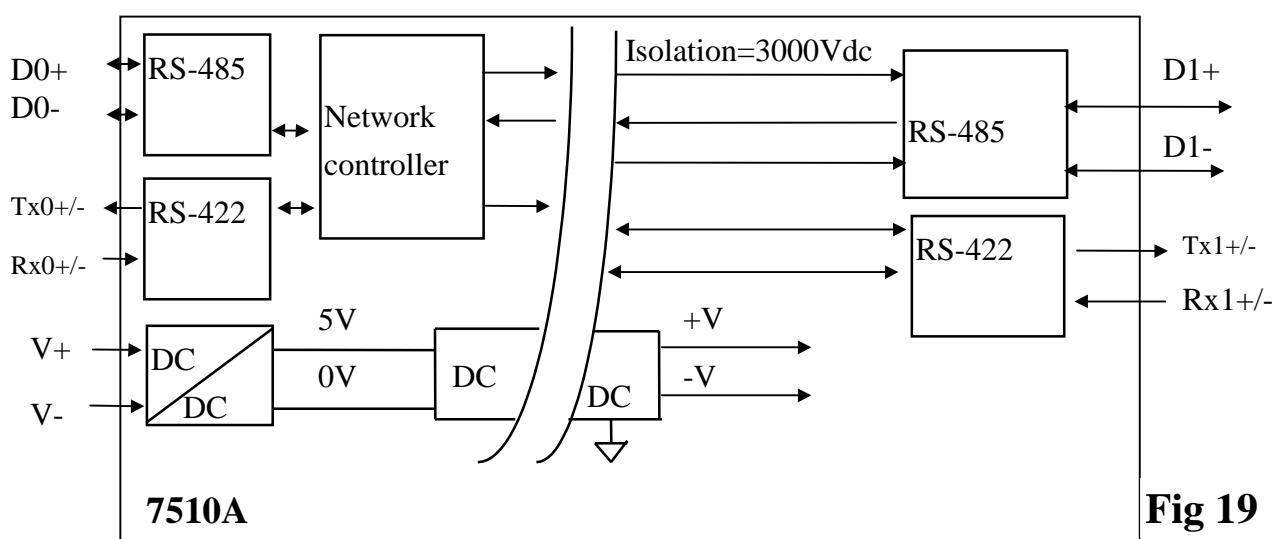


Fig 19

3.4 Basic Wire Connection

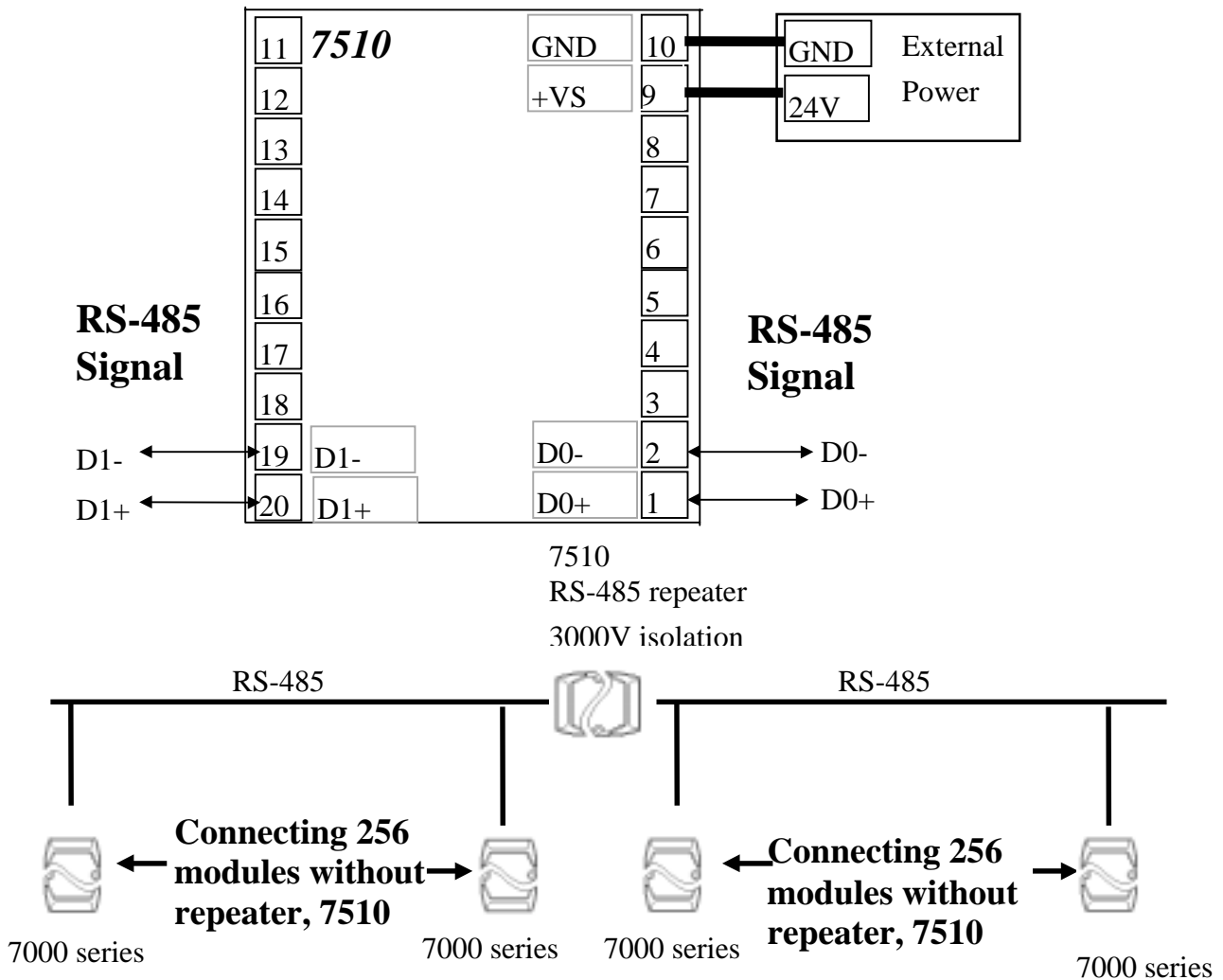


Fig 20

The three functions of 7510 are given as following : (refer to Sec. 2.6 for details)

- (1) **extend RS-485 network if the path is over 4000 ft or 1.2 Km**
- (2) **extend RS-485 network if connecting over 256 modules**
- (3) **cut the long RS-485 path into several isolated short RS-485 path for protection**

4. 7000 RS-485 Networking

4.1 Standard/Isolation Configuration

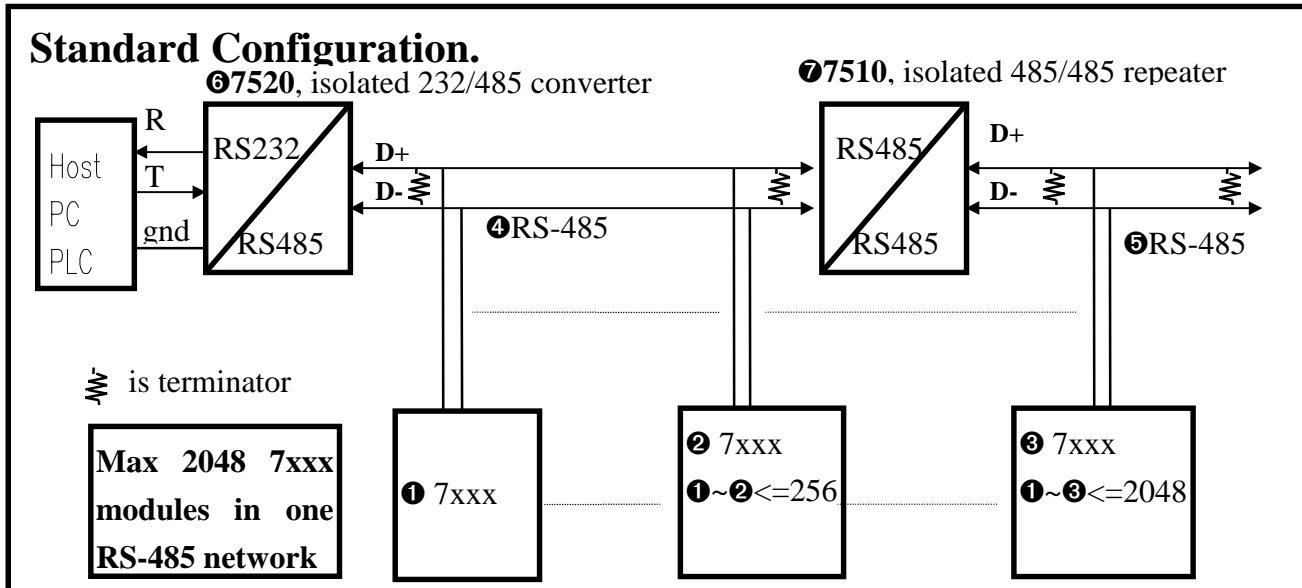


Fig 21

The Host PC/PLC will send out command string from its RS-232 port. The ⑦520 will convert these RS-232 signal into RS-485 signal and isolate the host from ④RS-485 network.

The 7000 series modules, including D/I, D/O, A/D, D/A, Timer/Counter and MMI modules, will be direct connected to ④RS-485. These 7000 series modules can connect max. 256 modules in the ④RS-485 network without repeater, 7510. That it to say, there can be 256 modules from ①7xxx to ②7xxx. If the modules are over 256 modules, the repeater 7510 must be added to extend the ④RS-485 to ⑤RS-485. Then there can be another 256 modules connecting in the ⑤RS-485 network. **This is the first function of 7510.**

The module address can be changed from 00 to FF total 256 max., therefore there are max. 256 modules in one RS-485 network if all the modules communicate with the same speed.

(1) Because the 7000 can communicate with different baud rate in the same RS-485 network, the ①7xxx, ②7xxx and ③7xxx can be communicated to HOST PC/PLC with different baud rate.

- (2) The 7000 series can be programmed to 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, totally 8 different speed.
- (3) The 7000 modules can share the same module address if their baud rate are different. For example,

❶7xxx=module address 01, baud rate=1200

❷7xxx=module address 01, baud rate=9600

❸7xxx=module address 01. Baud rate=115200

These three modules can share the same RS-485 network, generated by ❹7520.

- (4) Therefore there are 256*8=2048 modules max. in one RS-485 network with repeater(7510).

The " search function" given in NAP7000S can search all these 2048 modules in one RS-485 network. Refer to " NAP7000S User Manual" for completely source listing of " search function" .

When the RS-485 network is over 4000 ft or 1.2Km, the RS-485 repeater(7510) must be added to extend the RS-485 network. For example, if the ❹RS-485 is over 4000 ft or 1.2 Km, the ❷7510 must be added to extend ❹RS-485 to ❺RS-485. And if the ❺RS-485 is too long, the user should use another 7510 to extend another RS-485 network. **This is the second function of 7510.**

The power ground of 7000 is common ground to RS-485 network. This feature is the same as Adam 4000, Nudam 6000 and DATAFORTH 9B series. Therefor all the modules in the same RS-485 network are common ground. For example, all the modules between ❶7xxx and ❷7xxx share the same ❹RS-485 network and all are common ground. The ❹RS-485 length can be up to 4000 ft or 1.2 km, this is a very long path. This long path make RS-485 network very easy to couple noise by high energy transient on the environment. If these noise is too large, all the modules in this RS-485 network may be damaged at the same time. This is possible and occur often in real world application. It is strongly recommended to add another isolation repeater, 7510, to break the long path RS-485 network into several short RS-485 network to avoid all the modules damaged at the same time. **This is the third function of 7510.**

For example, the ❹7510, ❺7510, ❻7510 in Fig 22 are used to isolate local modules from ❶RS-485 network. If there are high energy transient on ❶RS-485 network, all the local modules will be safe. Therefor we strongly recommend the user to select isolation connection, refer to Fig 22.

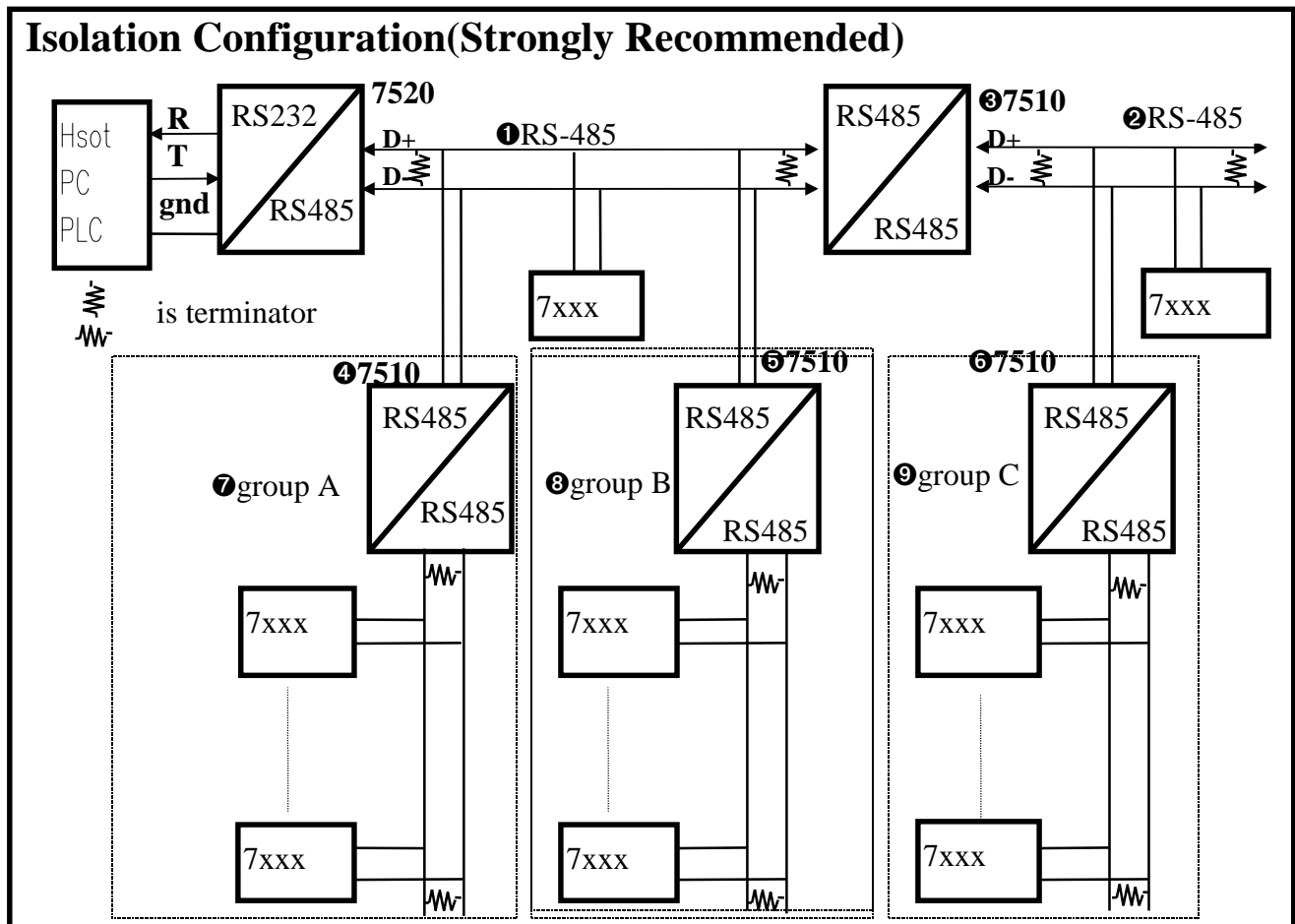


Fig 22

If the RS-485 network is not over 100 meter, the terminated resistors are not needed. However, it may be necessary to insert two terminated resistors in both end of RS-485 segment. It is not easy to calculate the value of terminator resistor. The best way is to use scope to check the RS-485 signal directly. If the impedance match of RS-485 network is OK, the scope will show a very nice square wave. If these square wave signals are distorted, the user need to insert two terminators in both end of RS-485 segment.

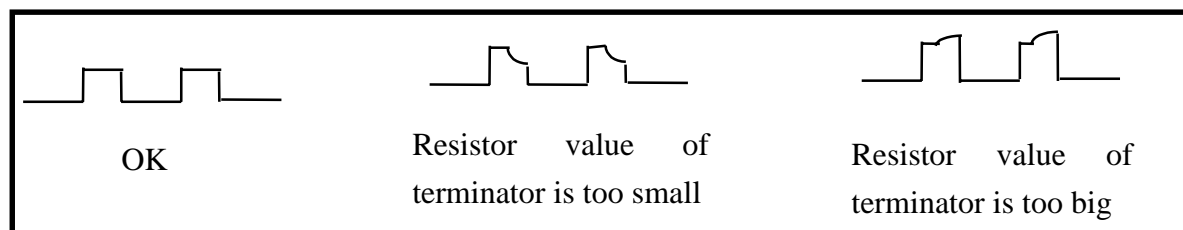


Fig 23

It is recommended to use " try and error" rule. The try and error rules are given as following:

- (1) If the length of RS-485 is about 1.2 Km, try 110• first
If the length of RS-485 is about 600 m, try 220• first
If the length of RS-485 is about 300 m, try 330• first
- (2) Run TEST.EXE of NAP7000S
Select function_5, run at least continue 8 hours to make sure communication OK
- (3) If function_5 find many communication errors, use scope to check the wave form. The wave form will tell you wheather the terminator is too small or too big. Then adjust your terminator and run TEST.EXE again.
- (4) If the correct terminators are found, run the TEST.EXE continuously at least 8 hour to make sure no communication error.

The function_5 of TEST.EXE, given in NAP7000S, will automatically read " testing command" from TEST.DAT and perform " send-receive-testing" continuously. It will continuously test and record all testing results. Therefore this function is special designed for RS-485 network stability evaluation. If you run function_5 for 8 hours continuously and find no any check error, this means that your RS-485 network is very stable now. Also this means that your terminator match well now.

NOTE 1 : The value of terminator is depended on the RS-485 wire used. If the RS-485 path is very long, don't use the cheaper wire. It is recommended to select the high quality wire such as Belden 1583A.

NOTE 2 : The terminator is different for various applications. Therefore we can not provide terminator with 7520 or 7510. The user must choose his correct terminator himself. It is recommended to use carbon, 1/4w resistor.

4.2 PLC Networking Application

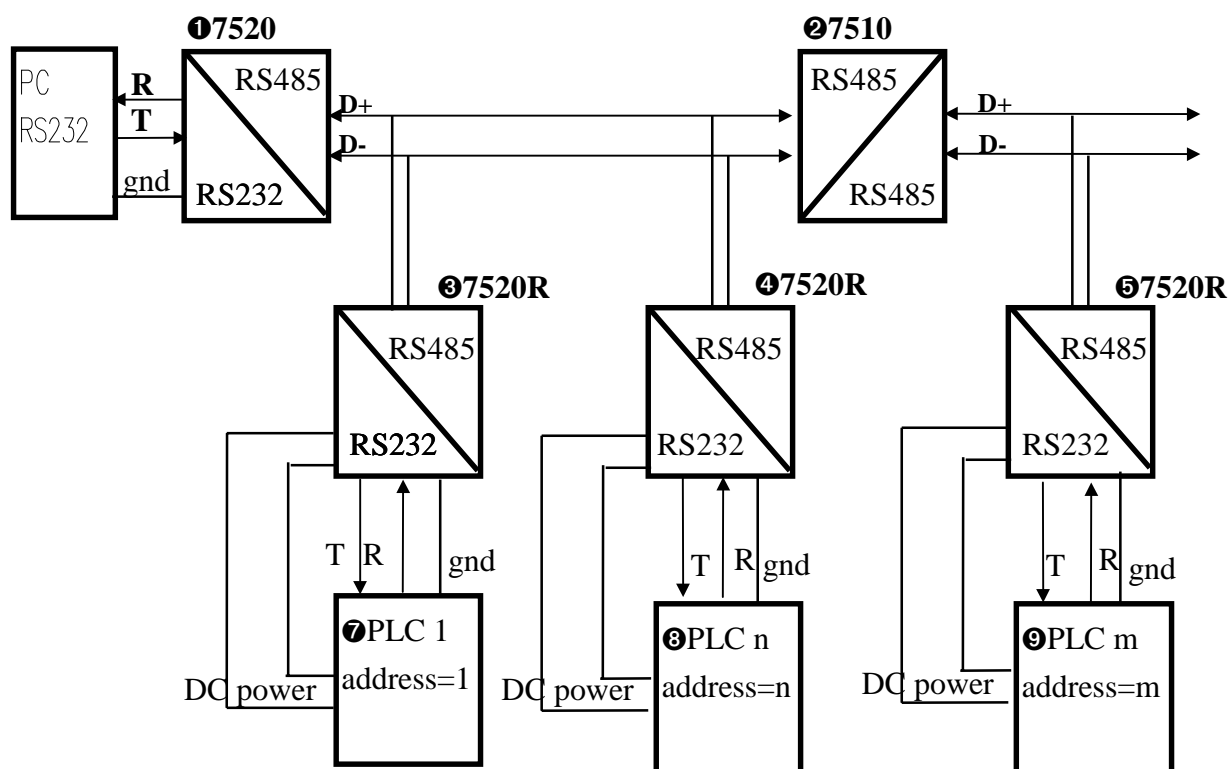


Fig 24

These PLCs can be used in **different baud rate & different configuration**. For example,

PLC-1=1 start + 7 data + 1 stop=9-bit/byte, baud rate=1200

PLC-n=1 start + 8 data + 1 parity + 1 stop=11-bit/byte, baud rate=9600

PLC-m=1 start + 8 data + 1 parity + 2 stop=12-bit/byte, baud rate=115200

**OMRON CQM1 = 1 start + 7 data + 1 even parity + 2 stop
=11-bit/byte**

**OMRON C200 = 1 start + 7 data + 1 even parity + 2 stop
= 11-bit/byte**

The 7520 can be 7520 or 7520R, refer to Sec. 2.5 for details.

The 7520R, 7520R, 7520R can be 7520 or 7520R, refer to Sec. 2.5 for details. In this configuration, the 7PLC1, 8PLCn, 9PLCm provide DC power to 7520R, 7520R, 7520R. This is the most cheap way and can maintain the 3000V high isolation. The user should not replace these 7520R, 3, 4, 5, to 7520.

Refer to "NAP7000S User Manual" for PLC networking software details.

4.3 PC Networking Application

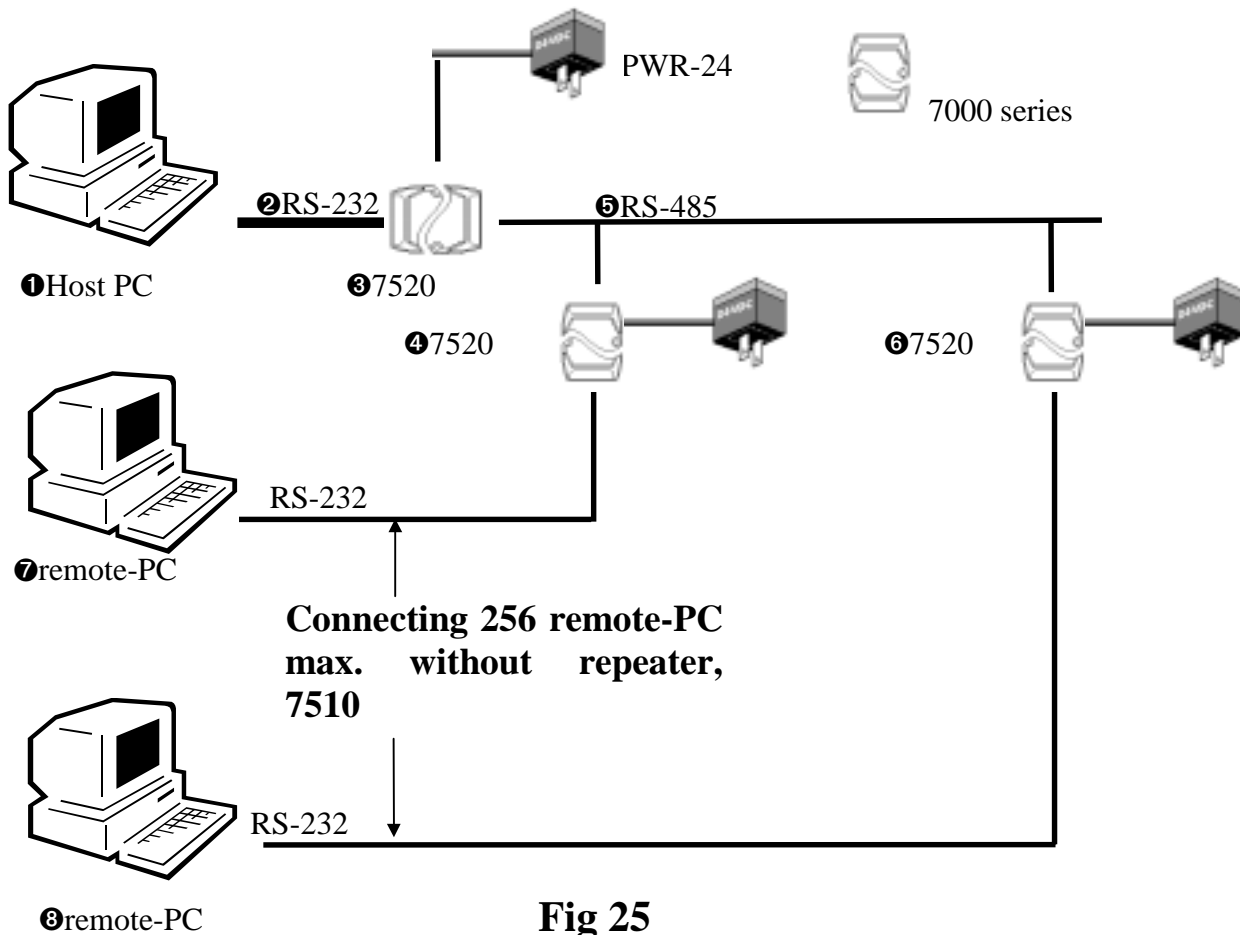


Fig 25

Every remote-PC must have a unique address. This unique address is similar to the module address of 7000 series. We call it "slave-PC address". The module address of 7000 is limited to 256, but the slave-PC address is unlimited. The user can connect thousands of PCs in one RS-485 network by using repeater, 7510.

Refer to "NAP7000S User Manual" for software details. Using this software, the host-PC can send out command to remote-PC, just like send out command to 7000 modules. The remote-PC will receive command and execute command if the destination address matches with his local address.

This remote-PC and 7000 series modules can use the same RS-485 network. The host-PC can send out 7000 command and send out PC-networking command at different times. These modules and remote-PC will receive their commands respectively. This makes the network very low cost, flexible and reliable. This is a unique feature in the world.

4.4 RS-232 Devices Network

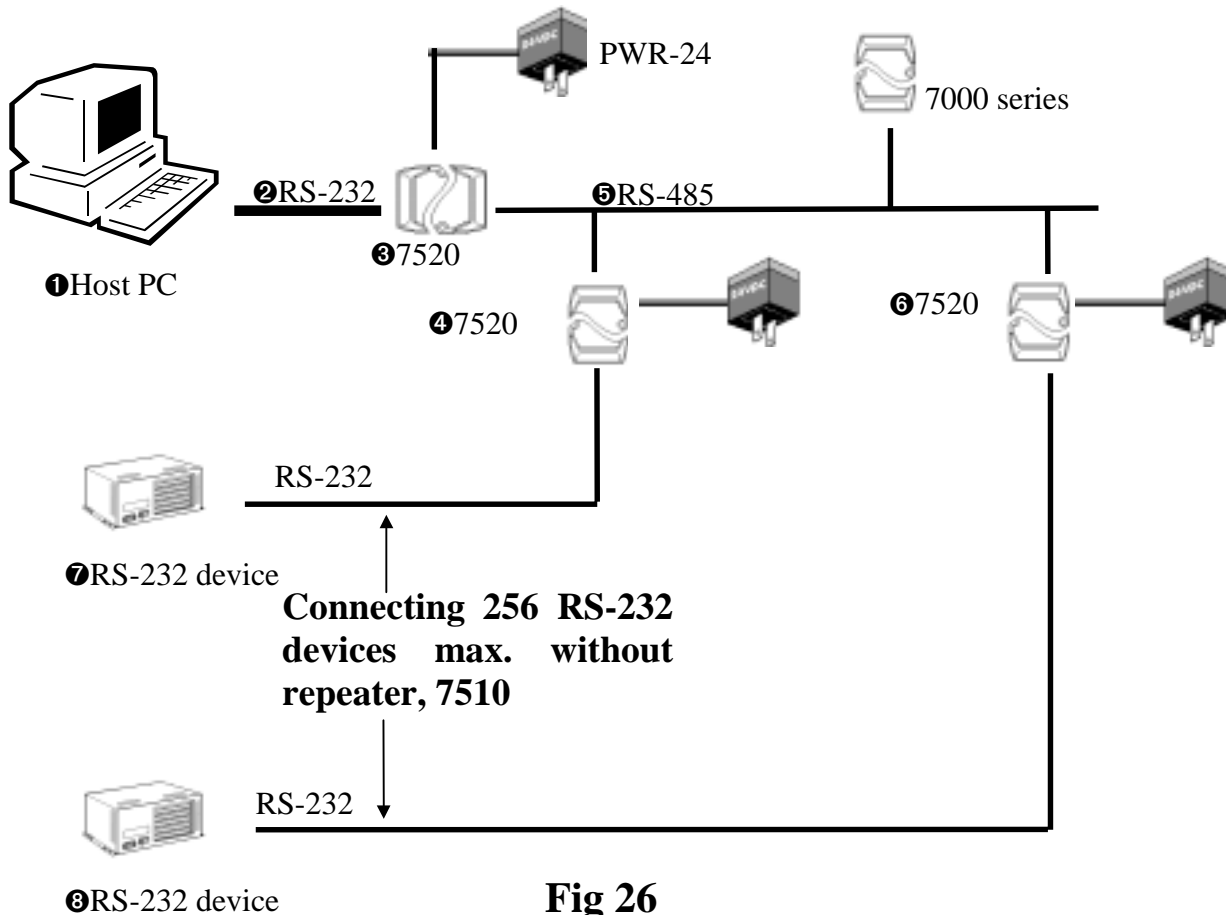


Fig 26

Some RS-232 devices can be connected to 7000 RS-485 network very easy just like PC or PLC introduced in Sec 2.7 and Sec. 2.8. These RS-232 devices must follow 3 rules given as following :

Rule 1 : can not send out RS-232 signal in the normal condition

Rule 2 : every device has a unique device address

Rule3 : will not send out RS-232 signal if the destination address is not match with the device address

The software for RS-232 device networking and PLC networking is very similar. The only difference is the command format. The command format of PLC are always different for different manufacturer. Refer to " NAP000S User Manual" for software details.

5. 7000 Quick Start

5.1 Find Status of Unknown Module

Wire connection : refer to Sec. 2.4

Test program : refer to " NAP7000S User Manual" for
TEST.EXE

Connect **INIT*_pin** to **GND_pin** first as following.

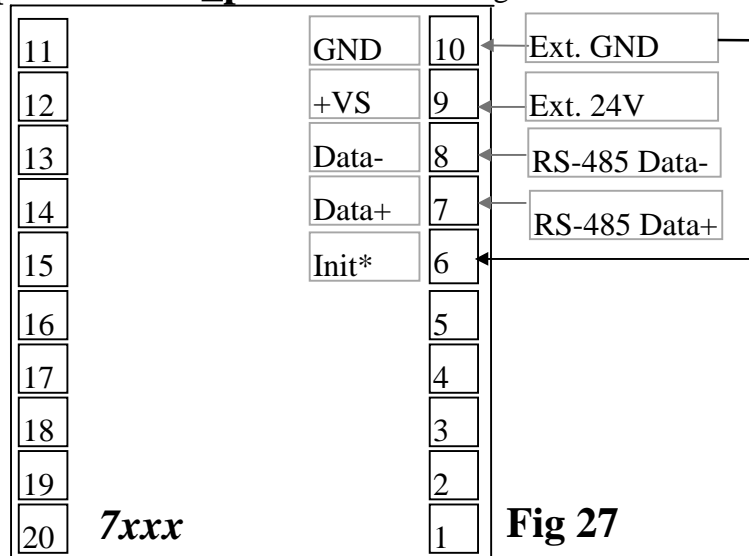


Fig 27

The steps to find the status of the unknown module are given as following.

1. Wire connection, **INIT*_pin=GND**, power on and run **test.exe**
2. press **2**
3. press **\$002[Enter]** → Receive=!**02080A40**
4. press **2**
5. press **%0001080600[Enter]**→ Receive=!**01**
6. power off, disconnect **INIT*_pin** (pin 6) and **GND_pin** (pin_10) and power on
7. press **2**
8. press **\$012[Enter]** → Receive=!**01080600**
9. press **2**
10. press **\$01M[Enter]** → Receive=!**017017**
11. press **2**
12. press **\$01F[Enter]** → Receive=!**01A1.3**

NOTE:If the **INIT*-pin** is connected to **GND-pin**, the **7xxx** will go to its default setting as following:

- (1) module address=00
- (2) baud rate=9600
- (3) checksum is disable

- step 3 : read the module status with INIT*_pin connecting to GND_pin and find that module address=02, baud rate= 115200, checksum is enable.
- step 5 : change this module to address=01, baud rate=9600, checksum disable
- step 6-12 : disconnect the INIT*_pin and read back the module status

5.2 Change Module Address

Wire connection : refer to Sec. 2.4

Test program : refer to " NAP7000S User Manual" for
TEST.EXE

The steps to change module address are given as following.

1. Wire connection, power on and run **test.exe**
2. press **2**
3. press **\$012[Enter]** → Receive=!01080600
4. press **2**
5. press **%0102080600[Enter]**→ Receive=!02
6. press **2**
7. press **\$022[Enter]** → Receive=!02080600
8. press **2**
9. press **\$02M[Enter]** → Receive=!027017
10. press **2**
11. press **\$02F[Enter]** → Receive=!02A1.3

- step 3: read the module status and find that module address=01, baud rate= 9600, checksum is enable.
- step 5: change the module address from 01 to 02, the module address can be changed immediately, no need to power-off then power-on
- step 7: read the module status based on the module address=02
- step 9: read the module name
- step 11 : read the firmware number of this module

NOTE : If the user use \$AA2 command to change module configuration, the new configuration code will be stored into EEPROM immediately. The configuration code includes module address, module type, baud rate code, checksum enable/disable code, calibration code, power-on value and safe value. The EEPROM data of 7000 can be read infinite times and can be written about 100,000 times max. Therefore the user should not change configuration code often for testing.

5.3 Change Baud Rate

Wire connection : refer to Sec. 2.4

Test program : refer to " NAP7000S User Manual" for
TEST.EXE

The steps to change the baud rate of communication are given as following.

1. Wire connection, power on and run **test.exe**
2. press **2**
3. press **\$012[Enter]** → Receive=!01080600
4. press **2**
5. press **%0101080A00[Enter]** → Receive=?01
6. connect INIT*_pin (pin 6) to GND_pin (pin_10)
7. press **2**
8. press **%0101080A00[Enter]** → Receive=!01
9. press **2**
10. press **\$012[Enter]** → Receive=!01080A00
11. power off, disconnect INIT*_pin and
GND_pin, power on and run **test.exe**
12. press **0**
13. press **1[Enter]**(1/2/3/4 for COM 1/2/3/4)
14. press **115200[Enter]**
15. press **0[Enter]**
16. press **2**
17. press **\$012[Enter]** → Receive=!01080A00

- step 3 : read the module status, baud rate=9600
- step 5 : change baud rate with INIT*_pin floating and find that the function is failure. If the user want to change the baud rate of the 7000 module, the INIT*_pin must be connecting to GND_pin. If the INIT*_pin is left floating (unconnected), the 7000 module will echo ?AA to the user.
- step 8 : change baud rate to 115200 with INIT*_pin connecting to GND_pin. After this command, the baud rate will be still keeping in 9600. The baud rate of 7000 will be changed only during the power-on interval.

NOTE:

- (1) To change the baud rate, the INIT*-pin must be connected to GND-pin
- (2) The baud rate will be saved into EEPROM immediately.
- (3) The module will change its baud rate only during the first power-on time.

- step 10 : read the module status, baud rate= 115200(this value, is stored in the EEPROM only). The baud rate is changed in step 8 but the baud rate of this module is still in 9600 BPS. When the module is power-off-and-power-on, the baud rate will be changed to 115200.
- step 11 : power off, then power on. The module will change its baud rate based on EEPROM value only when the module is first power-on
- step 13-16 : change TEST.EXE to baud rate 115200
- step 17 : use baud rate 115200 to read back the module status and find that the module is now communicate with baud rate 115200.

5.4 Checksum Enable/Disable

Wire connection : refer to Sec. 2.4

Test program : refer to " NAP7000S User Manual" for
TEST.EXE

The steps to enable/disable checksum status are given as following.

1. Wire connection, power on and run **test.exe**
2. press **2**
3. press **\$012[Enter]** → Receive=!**01080600**
4. press **2**
5. press **%0101080640[Enter]**→ Receive=?**01**
6. connect INIT*_pin (pin 6) to GND_pin (pin_10)
7. press **2**
8. press **%0101080640[Enter]**→ Receive=!**01**
9. press **2**
10. press **\$012[Enter]**→ Receive=!**01080640**
11. power off, disconnect INIT*_pin and GND_pin
12. power on and run test.exe, then press **0**
13. press **1[Enter]**(1/2/3/4 for COM 1/2/3/4)
14. press **9600[Enter]**
15. press **1[Enter]**
16. press **2**
17. press **\$012[Enter]**→ Receive=!**01080640B1**

NOTE:

- (1) To enable the checksum, the INIT*-pin must be connected to GND-pin
- (2) The checksum status will be saved into EEPROM immediately.
- (3) The module will change its checksum state only during the first power-on time
- (4) The TEST.EXE will send out the extra checksum byte if checksum is enable.
- (5) The 7000 will echo the extra checksum byte. The extra checksum byte is "B1" in this example.

- step 3 : read the module status, chksum=DISABLE
- step 5 : enable checksum with INIT*_pin floating, so function failure. If the user want to enable the checksum bytes of the 7000 module, the INIT*_pin must be connected to GND_pin. If the INIT*_pin is left floating (unconnected), the 7000 module will echo ?AA to the user.
- step 8 : enable checksum with INIT*_pin connected to GND_pin. After this command, the checksum is also in DISABLE state. The state of checksum will be changed only during the power-on interval. But the checksum status is saved into EEPROM immediately.
- step 10 : read the module status from EEPROM and find the checksum is in ENABLE state. The state of checksum is changed in step 8 but this module is still in checksum DISABLE now. Only when the module is power-off-and-power-on, the state of checksum will be initiated to ENABLE
- step 11 : power off, disconnect the INIT*_pin and GND_pin. Power on. The checksum status of this module is enable now.
- step 12-17 : change TEST.EXE to baud rate 9600 and checksum enable, then read back the module status and find that the module is in checksum enable state now.

The steps to compute checksum are given as following:

1. step 1: checksum=0;
2. step 2: for all command byte checksum = checksum + command byte
3. step 3: checksum=checksum&0xff
4. step 4 : convert checksum to ASCII high byte and ASCII low byte

for example, command = **\$012[Enter]**
 checksum = **\$+0+1+2=0x24+0x30+0x31+0x32=0xB7**
 checksum & 0xff = 0xB7
 checksum ASCII high byte = ASCII B = 0x42
 checksum ASCII low byte = ASCII 7 = 0x37
 command with checksum = **\$012B7[Enter]**

5.5 QBASIC Demo Program

It is very easy to use QB to send out RS-232 command. The program listing is given as following:

```
10 OPEN "COM1:9600,N,8,1,RS,CS,CD,DS" AS #1
20 CMD$="$012"
30 PRINT #1, CMD$
40 RESULT$=INPUT$(9,#1)
50 PRINT "Send=$012 --> Receive=",RESULT$
60 CLOSE:END
```